WHAT IS CLAIMED IS:

1   1.   A method of retaining an active subscriber
2   record in a Home Location Register (HLR) for a mobile
3   station operating in a radio telecommunications network
4   when the mobile station switches from a voice mode to a
5   data mode, said method comprising the steps of:
6   transmitting from the mobile station to a serving
7   base station, a power-down registration message that
8   includes a Data Mode Indicator (DMI);
9   sending the power-down registration message and DMI
10   from the base station to a serving Mobile Switching
11   Center (MSC);
12   sending from the MSC to the HLR, a registration
13   cancellation message that includes the DMI; and
14   in response to receiving the DMI, setting an
15   indicator in the subscriber record in the HLR indicating
16   that the mobile station is operating in the data mode.

1   2.   A method of preventing a call-setup timer in an

2   interrogating Mobile Switching Center (MSC) from expiring

3   when an incoming voice call is made to a called mobile

4   station (MS) that is operating in a data mode in a radio

5   telecommunications network having a voice network portion

6   and a data network overlay, said voice network portion

7   including a Home Location Register (HLR) for the called

8   MS, said method comprising the steps of:

9   setting an indicator in the HLR indicating that the

10 called MS is operating in the data mode;

11   receiving in the interrogating MSC, the voice call

12 from the calling MS;

13   sending a location request message from the

14 interrogating MSC to the HLR;

15   determining from the indicator in the HLR that the

16 called MS is operating in the data mode;

17   sending from the HLR to the interrogating MSC, a

18 first response to the location request message, said

19 first response directing the interrogating MSC to wait

20 for a second response; and

21   suspending the call-setup timer in the interrogating

22 MSC.

1   3.   The method of claim 2 wherein the step of
2 setting an indicator in the HLR indicating that the
3 called MS is operating in the data mode includes
4 receiving in the HLR a Data Mode Indicator (DMI) from the
5 called MS, said DMI being sent by the called MS when
6 switching to the data mode.

1   4.   A method of notifying a called mobile station
2 (MS) that an incoming voice call from a calling MS is
3 waiting when the called MS is operating in a data mode in
4 a radio telecommunications network having a voice network
5 portion and a data network overlay, said voice network
6 portion including a Home Location Register (HLR) for the
7 called MS, said method comprising the steps of:
8   setting an indicator in the HLR indicating that the
9 called MS is operating in the data mode;
10   sending a location request message from an
11 interrogating Mobile Switching Center (MSC) to the HLR;
12   determining from the indicator in the HLR that the
13 called MS is operating in the data mode; and
14   sending from the HLR through the data network
15 overlay to the called MS, an indication that the voice
16 call is waiting.

1   5.   The method of claim 4 wherein the step of
2 setting an indicator in the HLR indicating that the
3 called MS is operating in the data mode includes
4 receiving in the HLR a Data Mode Indicator (DMI) from the
5 called MS, said DMI being sent by the called MS when
6 switching to the data mode.

1   6.   The method of claim 4 further comprising
2 preventing a call-setup timer in the interrogating MSC
3 from expiring while the indication that the voice call is
4 waiting is sent to the called MS.

1   7.   The method of claim 6 wherein the step of
2 preventing the call-setup timer from expiring includes
3 the steps of:
4   sending from the HLR to the interrogating MSC, a
5 first response to the location request message, said
6 first response directing the interrogating MSC to wait
7 for a second response; and
8   suspending the call-setup timer in the interrogating
9 MSC.

1   8.   A method of setting up an incoming voice call
2   from a calling mobile station (MS) to a called MS that is
3   operating in a data mode in a radio telecommunications
4   network having a voice network portion and a data network
5   overlay, said voice network portion including a first
6   Mobile Switching Center (MSC-1) serving the called MS, a
7   Home Location Register (HLR) that stores a user record
8   for the called MS, and a second MSC (MSC-2) serving a
9   calling MS, and said data network overlay including a
10   Mobile Data Immediate System (MDIS) serving the called MS
11   and a gateway connecting the MDIS to an Internet Protocol
12   (IP) network, said method comprising the steps of:
13   notifying the called MS that the incoming voice call
14   is waiting;
15   determining whether the called MS accepted the
16   incoming voice call;
17   preventing a call-setup timer in MSC-2 from expiring
18   while notifying the called MS that the incoming voice
19   call is waiting and while determining whether the called
20   MS accepted the incoming voice call; and
21   delivering the incoming voice call to the called MS
22   upon determining that the called MS accepted the incoming
23   voice call.

1   9.   The method of claim 8 further comprising the

2   step of retaining an active user record in the HLR for

3   the called MS when the called MS switches from a voice

4   mode to the data mode, said record indicating that the

5   called MS is operating in the data mode.

1   10. The method of claim 9 wherein the step of

2   retaining an active user record in the HLR for the called

3   MS includes the steps of:

4   transmitting from the mobile station to a serving

5   base station, a power-down registration message that

6   includes a Data Mode Indicator (DMI);

7   sending the power-down registration message and DMI

8   from the base station to MSC-1;

9   sending from MSC-1 to the HLR, a registration

10 cancellation message that includes the DMI; and

11   in response to receiving the DMI, setting an

12 indicator in the user record in the HLR indicating that

13 the mobile station is operating in the data mode.

1   11. The method of claim 8 wherein the step of

2   notifying the called MS that the incoming voice call is

3   waiting includes the steps of:

4   determining from the user record in the HLR that the

5   called MS is operating in the data mode; and

6   sending from the HLR through the data network

7   overlay to the called MS, an indication that the voice

8   call is waiting.

1   12.   The method of claim 8 wherein the step of

2   preventing a call-setup timer in MSC-2 from expiring

3   includes the steps of:

4   receiving in MSC-2, the voice call from the calling

5   MS;

6   sending a location request message from MSC-2 to the

7   HLR;

8   determining from the user record in the HLR that the

9   called MS is operating in the data mode;

10   sending from the HLR to MSC-2, a first response to

11   the   location   request   message,   said   first   response

12   directing MSC-2 to wait for a second response; and

13   suspending the call-setup timer in MSC-2.

1   13.   The method of claim 8 further comprising

2   placing an ongoing data call on hold upon determining

3   that the called MS accepted the incoming voice call.

1   14. The method of claim 13 further comprising the

2   steps of:

3   determining that the called MS is switching back to

4   the data mode; and

5   reconnecting the ongoing data call on hold.

1   15. A method of setting up an incoming voice call

2   from a calling mobile station (MS) to a called MS that is

3   operating in a data mode in a radio telecommunications

4   network having a voice network portion and a data network

5   overlay, said voice network portion including a first

6   Mobile Switching Center (MSC-1) serving the called MS, a

7   Home Location Register (HLR) for the called MS, and a

8   second MSC (MSC-2) serving a calling MS, and said data

9   network overlay including a Mobile Data Immediate System

10   (MDIS) serving the called MS and a gateway connecting the

11   MDIS to an Internet Protocol (IP) network, said method

12   comprising the steps of:

13   setting an indicator in the HLR indicating that the

14   called MS is operating in the data mode;

15   receiving in MSC-2, the voice call from the calling

16   MS;

17   sending a location request message from MSC-2 to the

18   HLR;

19   determining from the indicator in the HLR that the

20   called MS is operating in the data mode;

21   sending from the HLR through the data network

22   overlay to the called MS, an indication that the voice

23   call is waiting;

24   sending from the HLR to the interrogating MSC, a

25   first response to the location request message, said

26   first response directing the interrogating MSC to wait

27   for a second response;

28   suspending the call-setup timer in the interrogating

29   MSC;

30   determining by a voice/data application server in

31   the data network overlay, whether the called MS accepted

32   the incoming voice call;

33   placing an ongoing data call on hold by the

34   application server, upon determining that the called MS

35   accepted the incoming voice call;

36   determining by the HLR, whether the called MS

37   accepted the incoming voice call; and

38   upon determining that the called MS accepted the

39   incoming voice call:

40   obtaining by the HLR, a routing number for the

41   called MS from MSC-1;

42   sending a second response to MSC-2, said second

43   response including the routing number for the called MS;

44   and

45   routing the voice call to the called MS.

1   16. The method of claim 15 wherein the step of
2   determining whether the called MS accepted the incoming
3   voice call includes receiving in the HLR, a registration
4   message from the called MS.

1   17. The method of claim 15 wherein the step of
2   determining whether the called MS accepted the incoming
3   voice call includes receiving in the HLR, an indication
4   from the called MS, routed through the MDIS and gateway,
5   that the called MS did not accept the incoming voice
6   call.

1   18. The method of claim 17 further comprising, upon
2   determining that the called MS did not accept the
3   incoming voice call, sending a second response to MSC-2,
4   said second response including an indication that the
5   called MS did not accept the incoming voice call.

1   19. A method of setting up an incoming data call
2   from a calling mobile station (MS) to a called MS that is
3   operating in a voice mode in a radio telecommunications
4   network having a voice network portion and a data network
5   overlay, said voice network portion including a first
6   Mobile Switching Center (MSC-1) serving the called MS, a
7   Home Location Register (HLR) for the called MS, and a

8   second MSC (MSC-2) serving a calling MS, and said data

9   network overlay including a Mobile Data Immediate System

10   (MDIS) serving the called MS and a gateway connecting the

11   MDIS to an Internet Protocol (IP) network, said method

12   comprising the steps of:

13   sending a Short Message Service (SMS) message

14   containing a Data Waiting Indicator (DWI) to the called

15   MS;

16   determining whether the called MS accepted the

17   incoming data call; and

18   routing the incoming data call to the called MS upon

19   determining that the called MS accepted the incoming data

20   call.

1   20. The method of claim 19 further comprising,

2   before the step of sending an SMS message, the steps of:

3   receiving the incoming data call in an application

4   server in the data network overlay; and

5   sending a data waiting message from the application

6   server to a message center (MC) in the voice network

7   portion.

1   21. The method of claim 19 further comprising

2   placing an ongoing voice call on hold upon determining

3   that the called MS accepted the incoming data call.

1   22. The method of claim 21 further comprising the
2   steps of:

3   determining that the called MS is switching back to
4   the voice mode; and

5   reconnecting the ongoing voice call on hold.

1   23. A system for setting up an incoming voice call
2   from a calling mobile station (MS) to a called MS that is
3   operating in a data mode in a radio telecommunications
4   network having a voice network portion and a data network
5   overlay, said voice network portion including a first
6   Mobile Switching Center (MSC-1) serving the called MS, a
7   Home Location Register (HLR) for the called MS, and a
8   second MSC (MSC-2) serving a calling MS, and said data
9   network overlay including a Mobile Data Immediate System
10   (MDIS) serving the called MS and a gateway connecting the
11   MDIS to an Internet Protocol (IP) network, said system
12   comprising:

13   an indicator in a user record in the HLR for the
14   called MS that indicates that the called MS is operating
15   in the data mode;

16   a voice/data application server in the data network
17   overlay that receives a notification from the HLR that
18   the voice call is waiting, and sends the notification
19   through the data network overlay to the called MS;

20   a signaling mechanism in the HLR that receives a
21 registration message from the called MS indicating that
22 the called MS accepted the incoming voice call;

23   call processing logic in the HLR that prevents a
24 call-setup timer in MSC-2 from expiring while the called
25 MS is notified that the incoming voice call is waiting,
26 and while it is determined whether the called MS accepted
27 the incoming voice call, said logic sending a first
28 response message to MSC-2 instructing MSC-2 to suspend
29 the timer until a second response message is received;
30 and

31   a signaling mechanism in the HLR for obtaining a
32 routing number for the called MS from MSC-1, and
33 returning the routing number to MSC-2 in the second
34 response message.

1   24. A system for setting up an incoming data call
2 from a calling mobile station (MS) to a called MS that is
3 operating in a voice mode in a radio telecommunications
4 network having a voice network portion and a data network
5 overlay, said voice network portion including a first
6 Mobile Switching Center (MSC-1) serving the called MS, a
7 Home Location Register (HLR) for the called MS, and a
8 second MSC (MSC-2) serving a calling MS, and said data
9 network overlay including a Mobile Data Immediate System
10 (MDIS) serving the called MS and a gateway connecting the

11   MDIS to an Internet Protocol (IP) network, said system

12   comprising:

13   a message center that sends a Short Message Service

14   (SMS) message containing a Data Waiting Indicator (DWI)

15   to the called MS;

16   a signaling mechanism in MDIS-1 for receiving a

17   registration message from the called MS, and for sending

18   the registration message to a voice/data application

19   server in the data network, said registration message

20   indicating that the called MS accepted the incoming data

21   call; and

22   a voice/data application server in the data network

23   overlay that receives the incoming data call from MDIS-2

24   and sends a data waiting message to the MC, said

25   application server also routing the incoming data call to

26   the called MS after the registration message indicates

27   that the called MS accepted the incoming data call.